

Claims

What is claimed is:

1. A load bearing arrangement for use with a work machine of the type having a platform, comprising:

at least one member structured and arranged for coupling to the platform;

said member having an end comprising a material having a first yield strength;

an aperture formed in said end and having an aperture wall;

at least one support member contained within said opening adjacent to at least a portion of said aperture wall; and

said support member having a second yield strength greater than said first yield strength.

2. The load bearing arrangement as set forth in claim 1 wherein said support member comprises a substantially cylindrical structure having a through opening.

3. The load bearing arrangement as set forth in claim 2 further comprising a bearing received in said opening.

4. The load bearing arrangement as set forth in claim 1 wherein said support member is laser welded to said end.

5. The load bearing arrangement as set forth in claim 1 wherein said member comprises:

at least one top plate;

at least one bottom plate; and

at least one pair of spaced apart side plates each attached to said top plate and said bottom plate.

6. The load bearing arrangement as set forth in claim 5 wherein said top plate comprises at least one integral mounting structure.

7. The load bearing arrangement as set forth in claim 5 further comprising:

a substantially cylindrical attachment structure extending from at least one said side wall; and

wherein said side wall is attached to said attachment structure.

8. The load bearing arrangement as set forth in claim 7 wherein:

said member has a transverse width; and

said attachment structure spans said transverse width.

9. The load bearing arrangement as set forth in claim 5 further comprising at least one reinforcing structure attached to at least one said side plate.

10. The load bearing arrangement as set forth in claim 9 wherein said reinforcing structure comprises:

a base portion; and

a rib portion extending from said base portion.

11. The load bearing arrangement as set forth in claim 9 wherein said reinforcement structure is laser welded to said side plate.

12. The load bearing arrangement as set forth in claim 1 wherein:  
said member comprises a first side and a second side;  
one of said first side or said second side comprises a plurality of side plates;  
each said side plate having a centerline axis; and  
at least two adjacent side plates on one of said first side or said second side are coupled together such that said centerline axis of each said side plate are colinear.

13. The load bearing arrangement as set forth in claim 1 further comprising an attachment pivotally coupled to said member.

14. The load bearing arrangement as set forth in claim 13 wherein said attachment comprises a bucket.

15. A load bearing arrangement for use with a work machine of the type having a platform, comprising:  
a plurality of pieces connectable to form a member structured and arranged for pivotable attachment to the platform;  
a weldment connecting at least two of said pieces; and  
at least one said weldment being simulated for effects of heat on at least one of said pieces subject to said weldment.

16. The load bearing arrangement as set forth in claim 15 wherein said effects are at least one of stress and deformation.

17. The load bearing arrangement as set forth in claim 15, further comprising:

an end attached to said member and comprising a material having a first yield strength;

an aperture formed in said end and having an aperture wall;

at least one support member contained within said opening adjacent to at least a portion of said aperture wall; and

said support member having a second yield strength greater than said first yield strength.

18. The load bearing arrangement as set forth in claim 17 wherein said support member comprises a substantially cylindrical structure having a through opening.

19. The load bearing arrangement as set forth in claim 18 further comprising a bearing received in said opening.

20. The load bearing arrangement as set forth in claim 18 wherein said support member is laser welded to said end.

21. The load bearing arrangement as set forth in claim 15 wherein said member comprises:

at least one top plate;

at least one bottom plate; and

at least one pair of spaced apart side plates each attached to said top plate and said bottom plate.

22. The load bearing arrangement as set forth in claim 21 wherein said top plate comprises at least one integral mounting structure.

23. The load bearing arrangement as set forth in claim 21 further comprising:

a substantially cylindrical attachment structure extending from at least one said side wall; and

wherein said side wall is attached to said attachment structure.

24. The load bearing arrangement as set forth in claim 23 wherein:

said member has a transverse width; and

said attachment structure spans said transverse width.

25. The load bearing arrangement as set forth in claim 21 further comprising at least one reinforcing structure attached to at least one said side plate.

26. The load bearing arrangement as set forth in claim 25 wherein said reinforcing structure comprises:

a base portion; and

a rib portion extending from said base portion.

27. The load bearing arrangement as set forth in claim 25 wherein said reinforcement structure is laser welded to said side plate.

28. The load bearing arrangement as set forth in claim 15 wherein:

said member comprises a first side and a second side;

one of said first side or said second side comprises a plurality of side plates;

each said side plate having a centerline axis; and  
at least two adjacent side plates on one of said first side or said second side are coupled together such that said centerline axis of each said side plate are colinear.

29. The load bearing arrangement as set forth in claim 15 further comprising an attachment pivotally coupled to said member.

30. The load bearing arrangement as set forth in claim 29 wherein said attachment comprises a bucket.

31. A load bearing apparatus, comprising:  
a work machine having a platform;  
at first member, having a longitudinal axis, coupled to said platform;  
a first movement means for moving said first member relative to said platform;  
a second member, having a longitudinal axis, pivotally coupled to said first member;  
a second movement means for moving said second member relative to said first member;  
a plurality of pieces connectable to form at least one of said first and second members;  
a weldment connecting at least two of said pieces; and  
at least one said weldment being simulated for effects of heat on at least one of said pieces subject to said weldment.

32. The load bearing apparatus as set forth in claim 31 wherein said first and said second movement means comprises hydraulic cylinders.

33. The load bearing apparatus as set forth in claim 31 further comprising an attachment attached adjacent an end of said second member.

34. The load bearing apparatus as set forth in claim 31 wherein said attachment comprises a bucket.

35. The load bearing arrangement as set forth in claim 31 wherein said effects are at least one of stress and deformation.

36. A method of manufacturing a load bearing member, comprising a plurality of pieces, for use with a work machine, comprising the steps of:

forming the pieces;  
connecting at least two of the pieces by a weldment; and  
determining the effects of heat caused by the weldment on at least one of said pieces subject to said weldment.

37. The method as set forth in claim 36 wherein said forming step is a performed by a thermal cutting process.

38. The method as set forth in claim 37 wherein said thermal cutting process is laser cutting.

39. The method as set forth in claim 36 wherein forming step includes a simulation step of simulating distortions of the pieces caused by said thermal cutting process.

40. The method as set forth in claim 36 wherein said welding process is a robotic process.

41. The method as set forth in claim 36 wherein said determining step includes the steps of:

determining a model of a geometry of the material;

defining a set of coordinates of elements and nodes of the geometry model for a finite element analysis mesh;

delivering the finite element analysis mesh coordinates to a thermal analysis model, the thermal analysis model including an analytical solution model and a finite element analysis model;

determining a thermal analysis of the welding process as a function of at least one of the analytical solution model and the finite element analysis model, the analytical solution model being adapted to provide a thermal history of the welding process for a global distortion analysis, and the finite element analysis model being adapted to provide a thermal history of the welding process for a detailed residual stress analysis;

delivering the thermal history of the welding process to a structural analysis model; and

providing a structural analysis of the welding process as a function of the thermal history.

42. The method as set forth in claim 36 wherein said determining step includes the steps of:

- determining a history annihilation model of a material being welded;
- determining a strain hardening model of the material being welded;
- determining a three-dimensional virtual elements detection model of the material being welded; and
- incorporating the above models into a constitutive model for the welding simulation.

43. The method as set forth in claim 36 wherein said determining step occurs during the creation of the weldment.

44. The method as set forth in claim 36 wherein said determining step occurs prior to the creation of the weldment.

45. The method as set forth in claim 36 wherein said effects are at least one of stress and deformation.

46. The method as set forth in claim 36 further comprising the step of modifying said connecting step to minimize the effects of the heat.